SOME POINTS

ON THE

PHYSICAL EXAMINATION OF THE CHEST

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*Some Points in the Physical Examination of the Chest.**

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THE paper I am about to read is not an orderly presentation of any topic, but rather a collection of disconnected observations upon several points relating to the physical examination of the chest, which seem to me to deserve more notice than they generally receive.

But before entering upon the special consideration of the points in physical diagnosis, I would emphasize the wisdom of limiting the examination in many instances to ascertaining only those facts that will influence the management of the case.

When the patient is strong enough to bear the fatigue incident to a thorough scrutiny of all the physical conditions present, we are justified in making an exhaustive examination, even though much of the information to be obtained cannot be expected to lead immediately to a practical result. Indeed, we may even be justified in a resaonable amount of physical investigation that has no other object in view than that of perfecting ourselves in the study of chest conditions.

But very often it is much wiser to forego the search for collateral or subsidiary conditions, in the presence of an easily recognizable disease, which plainly furnishes all the immediate indications for treatment, and at the same time renders a prolonged examination painful and hazardous. This is so obvious that it might be passed by were it not so frequently disregarded. Especially in our hospital practice, I fear we are too apt to overlook the rights of the patient in our zeal for thoroughness, and through apprehension that we may be confronted at the autopsy with something we had failed to discover, and this habit, formed in the hospital, too often goes with us into our private work. Particularly in consultations, the consultant is apt to feel called upon to vindicate his reputation by verifying for himself the findings of the perfectly competent practitioner in charge, and this, too, when there is no question of diagnosis, but merely of treatment. I have known this to result seriously to the patient, and in one instance that I recall, it obviously hastened the death that followed a few hours later. We

* Read before the Passaic Co., N. J., Medical Society, also before the Medical Society of the District of Columbia.

are sometimes warned against purturbating treatment ; it is well that we should refrain from unnecessarily purturbating examinations.

In a case of pulmonary hemorrhage, for example, when so much depends upon perfect quiet of both body and mind, it is far better to limit the examination to observing the temperature, pulse and respiration, and noting the general condition of the patient, than to submit him to the physical disturbance and mental agitation inseparable from an effort to appreciate the extent of the previous implication of the lung.

I do not deny that there are cases in which a complication may exist in addition to the principal affection, and which complication may have an important bearing upon the measures proper to be taken. Thus, a pneumonia may be complicated by a pleuritic effusion, and in a critical case paracentesis may be urgently demanded. To overlook such a condition would be a serious blunder, but if the possibility of such a complication is borne in mind, the signs would have to be obscure to make a prolonged examination necessary.

And this leads me to remark upon the importance of training ourselves to the quick appreciation of physical signs. If the mind is alert and the attention concentrated, as much may be learned by a single tap over each locality in the chest as by the customary three blows of the percussing finger. Much time is saved in this way, and what is more, much fatigue, and even positive suffering may be spared to the patient. In like manner the normal respiratory murmur, if heard through one cycle of inspiration and expiration in each place, is just as conclusive of the normal condition of the underlying lung as it would be if the auscultation were continued through any number of cycles. The same is true of abnormal sounds if their character is such as to be readily appreciated. It is only when we have a mixed or an uncertain sound that we need to linger over it.

In this connection I would say that, while the unaided ear is in many cases superior to any help in the form of a stethoscope, there are conditions in which such an instrument is almost indispensible. The patient's comfort is often sacrificed to the necessity of getting the ear into a position that can be made accessible only by a painful effort. I envy the colleague whose narrow shoulders and cameleopard neck seem purposely made for such occasions, but even he will often find a properly constructed stethoscope an immense help in examining a patient in the recumbent position. A slight turning from side to side will bring all portions of the thorax within reach of a flexible instrument, and save the necessity of lifting a very sick man into the sitting posture.

The improvement in medical appliances during the past decade is illustrated in nothing better than in the binaural stethoscope. The instrument of ten years ago was large and cumbersome, heavy to handle, and too bulky to be carried in the pocket. That of to-day is light and

graceful in appearance, and so small that it can be carried habitually in the coat pocket without the slightest inconvenience. The contrast is well shown by the two instruments before us.

There is also a form of binaural stethoscope but little known in this country, which was first brought to my notice by my friend, Dr. Sansom, of London. It is even more portable than the modern instrument we have just considered and, for any but the most accurate examination, is quite as serviceable. It consists, as you see, of a simple cup to which are fitted two rubber tubes, terminating in hard rubber tips. These tips are inserted a little distance into the respective auditory canals, where they are self retaining. This ingenious device is extremely convenient, as it is very light and flexible and occupies but little space, but it does not conduct the sound sufficiently well for a perfectly exact diagnosis. It has also the further disadvantage that the tips must be fitted to the size of the auditory canal of the auscultator, in order to maintain their position ; so that two persons may not be able to use the same instrument.

I have also a stethoscope here, which is not only binaural, but bibuccal, so to speak, as it has two bell-mouthed extremities, each attached to its respective ear piece. This instrument is designed to enable one to compare the sounds in two localities at the same time. Some little training is necessary to do this successfully, especially if there is the slightest difference in the hearing power of the two ears. The chief purpose for which I have found it really useful is in the study of cardiac sounds heard both at the apex and at the base. It quite often happens that it is difficult, if not impossible, to distinguish the first heart sound from the second, either by the rythm of the beats or the quality of the sound. This occurs when the cardiac action is quickened and the interval between the first and the second sound and second and first sound is the same. In such a case the heart's action is too rapid to permit one to determine which sound corresponds in time with the carotid pulse, and if a murmur is present, it may be impossible to decide whether it is systolic or diastolic. If now we have a murmur, both at the apex and at the base, we may not be able, by the ordinary methods, to tell whether they are synchronous or alternate. This point, at least, can be readily determined by the aid of the differential stethoscope. If we place one extremity over the base and the other over the apex, we can, with a little practice, tell whether we hear a murmur first with one ear and then with the other, or with both ears at once. In the first case there must be two bruits, one systolic and the other diastolic, and they are either both direct or both regurgitant. In the second case in which with each alternate sound a murmur is heard with both ears, there must be two murmurs, both systolic or both diastolic, one being direct and the other regurgitant.

Finally, when a murmur is heard by each ear with every sound, we have necessarily a double aortic and a double mitral lesion.

The mechanism of the so-called presystolic murmur has been the subject of much discussion. Many, if not most, authorities contend that it is diastolic, and is produced by the acceleration of the blood accompanying the contraction of the auricle, the mitral orifice being roughened by disease. It is urged in defence of this view that the murmur "leads up to, and is lost in the first sound." This would be conclusive if it could be shown that the first sound is synchronous with the beginning of the systole. But it is here that the opponents of this view take issue. They claim that the first sound is not produced until the systole had been an appreciable time in progress, this time being required to bring the valve flaps together, and to bring about the tension of the chordæ tendiniæ, which gives rise to the first sound, or at least to the valvular portion of it. During this interval between the beginning of the systole and production of the first sound the blood is running back into the auricle, and this regurgitation continues until the valve curtains, perhaps thickened at the base and not responding quickly to the pressure behind them, come together. This backward current, it is claimed, produces the "presystolic (?) murmur, which necessarily leads up to, and is lost in the first sound."

I am free to say that this has always seemed to me to be the more reasonable explanation. When we hear a door slammed to by the wind we know that the noise was preceded by a current of air blowing through the doorway. In like manner, when we hear the sound indicating that the mitral curtains have been thrown together by the pressure of the blood behind them, may we not infer that it was preceded by a backward flow of blood through the mitral opening? If a curtain is stretched before the doorway, and a gust of wind occurs, we may, if we are near enough, hear the curtain rustle for an instant before we hear the slamming of the door. In like manner, if there is a roughening of the mitral orifice, may we not hear the backward rushing of the blood over this uneven surface for an instant before we hear the closing of the valve?

But, as I said before, the whole discussion hinges upon whether the first sound occurs the instant the ventricle begins to contract, or a fraction of a second later. I am inclined to believe that the former is practically the case when the valve is in perfect health, but that when it is stiffened by disease, though still competent, its movement is sluggish, and a certain amount of regurgitation takes place before the closure is complete. This view is sustained by results reached throngh the use of the differential stethoscope.

While this paper was being prepared I had two patients in my wards in the Presbyterian Hospital, each presenting a systolic murmur, both at the base and at the apex. By means of the differential stethoscope

it was easy to establish the fact that in each case the mitral murmur preceded the aortic by an appreciable interval. There was a commencing regurgitation through the mitral valve before the current of blood set in the direction of the aortic orifice. The bearing of these observations upon the question of the production of the so-called presystolic murmur is apparent.

The first sound must be synchronous with the beginning of the flow through the aortic valve. Yet, here in two cases this flow is delayed, after the beginning of the systolic murmur, for a period quite as long as that usually occupied by the "presystolic bruit."

With the corroboration furnished by such cases, I cannot doubt that what is called the presystolic murmur often is really systolic, and, therefore, regurgitant, instead of direct.

This is a long degression, but I feel justified in making it in order to show the value of an instrument but very seldom employed.

While on the subject of the heart I will call attention to a murmur which I have met with a great many times, and which I think we should oftener find if we looked for it as a matter of routine in cases of muscular weakness from any cause. I refer to what the late Dr. Flint used to speak of as an intraventricular murmur. It is systolic in time and soft in character, and its greatest intensity is neither at the apex nor at the base, but about half way between. It is found in debilitated persons, but it is entirely distinct from the anæmic murmur, not only in its location, but also in not being accompanied by the murmurs in the neck, and the other evidences of thinness of the blood. It seems to be connected with cardiac debility, and Dr. Flint explained it by assuming that the papillary muscles failed to contract in unison with the ventricular wall. It presents no autopsical lesion, and is entirely recovered from when the general strength is restored.

In this connection, a case which occured recently under my observation possesses a special interest. A patient was admitted into the Presbyterian Hospital with the diagnosis of endocarditis. He had a moderate elevation of temperature and a systolic murmur. On examining him I found that the bruit was not in either of the situations in which we should expect to find it in endocarditis, but at the point where the intraventricular murmur is usually heard. But it was a very harsh sound, and, moreover, there was no history of a previous condition of debility. I also noticed that its intensity fluctuated with the respiratory movements. The patient was then directed to take a deep inspiration and to hold his breath. The bruit became much less distinct. Reversing the movement, the sound became again very loud and harsh. It was also found that the bruit could be intensified by firm pressure with the stethoscope, and that it was not heard in the axillary line. In view of these facts, the case was pronounced to be one of pericarditis,

with the friction sound heard only in systole. Twenty-four hours later articular rheumatism developed, the pericardium simply having been the first point of attack.

A tricuspid murmur occurs so rarely that, unless there is considerable regurgitation and the accompanying signs and symptoms are well marked, it is apt to be overlooked, or mistaken for a mitral bruit. Theoretically, it is heard at or near the xyphoid cartilage, is not propagated toward the axillary line, and is not audible posteriorly. But the murmur may be heard over a considerable area, and in a proportion of the cases there will be a mitral murmur also. Dislocation of the heart to the right and downward, resulting from former diseased condition in the pleura, is another possible source of error. Any additional sign, therefore, which helps to distinguish a tricuspid from a mitral bruit is of some interest.

A case that came under my notice, a short time ago, afforded such a sign, and it is quite possible it may have some degree of general availability. A patient presented a very marked systolic bruit of a musical character, heard most distinctly near the xyphoid cartilage. There was no considerable pulsation in the veins of the neck, and no pulsation of the liver. There was moderate dyspnœa on exertion, but no very decided pulmonary distress. Dropsy was absent. These conditions had led to the diagnosis of mitral incompetency, notwithstanding the situation of the murmur, and that it was not propagated toward the left. The disease had existed almost two years.

On examining this patient I found the conditions as above described, but I was struck with the fact that the intensity of the murmur was distinctly increased during inspiration. On causing the patient to make a deep, forcible inspiration, the sound became extremely loud, at least double in volume, but this increase of intensity was not maintained, for after the chest had reached its full expansion it ceased even before expiration began.

Reflecting upon this, I arrived at the conclusion that the murmur was produced at the tricuspid orifice, as its situation indicated, that the regurgitation was slight and through a narrow opening, and that, therefore, the reflux was not sufficient to considerably distend the jugulars or to cause pulsation of the liver. The extraordinary increase in the intensity of the bruit, during forcible inspiration, seemed to be explained by the negative pressure established in the auricle and the venous trunks by the rapid and forcible expansion of the thorax, thus offering less resistance to the backward current through the auriculo-ventricular opening. As the conditions favorable to this result do not exist to the same degree on the left side of the heart, I consider this increase of the bruit, with forcible inspiration, a confirmation of the tricuspid origin of the sound. Whether this sign will be found useful in any considerable

proportion of cases, remains to be determined, the rarity of tricuspid murmurs not offering frequent opportunities for observation.*

In a paper read at the International Congress in 1890, I called attention to the fact that the condition of the pulmonary circulation could not be inferred from an examination of the radial pulse, since it was the action of the right heart and not the left, that was in question. As we could not place the finger on the pulmonary artery, the next best thing we could do was to estimate the tension within it by the sound of the pulmonary valve. If this was sharp and loud we could infer two things: first, that there was obstrution in the pulmonary circulation, and second, that there was a fair amount of vigor in the right heart. For it is clear that the intensity of the valve sound is in proportion to the force with which the blood recoils against the cusps, and that this force in its turn is conditioned by the amount of resistance to be overcome in the pulmonary circulation on the one hand, and the vigor of the systole on the other. It is usually not difficult to distinguish changes in the pulmonary valve sound as heard in the second interspace, near the left edge of the sternum. Normally the combined pulmonary and aortic sounds at this point should be less distinct than the aortic sound alone, as conveyed to the right of the sternum. But when the tension in the pulmonary artery is increased, the sound at the left of the sternum gains in intensity. This is a most valuable sign in cases in which there is danger that the right heart will no tbe able to carry on the pulmonary circulation, as so often happens in pneumonia. So long as the sound in the second left interspace continues to be distinct, we may believe that the right heart is holding out. As the case progresses this sound may lose in distinctness from one of two causes. First, the resistance in the pulmonary circuit may diminish, thus lessening the tension in the pulmonary artery; or, second, the right heart may lose force from exhaustion, and be unable to distend the artery as fully as before. Which of these two causes is operating is easily decided by the condition of the patient. If there is diminished pulmonary resistance, there will be general relief, and less respiratory distress ; if the right heart is failing, these conditions will be reversed. In the first case, the prognosis becomes more favorable; in the second, it becomes extremely grave.

Of late years I have relied much upon this sign in obstructive cases of pneumonia, not only for prognosis, but as affording indications for treatment. The slightest dimunition in the intensity of the pulmonary second sound, unless it is accompanied by slower respiration, and lessened turgidity of the veins, should be the signal for measures tending to lighten the labor required of the right heart. Venesection might oft-

* Since the above was written, a second case has come under my notice with signs precisely similar, except that there was a mitral murmur in addition.

ener be resorted to with benefit; but much can be accomplished in the same direction by administering medicines that reduce arterial tension, thus relieving the veins of their excess of blood by making room for it in the arteries.

Before taking final leave of the subject of stethoscopes, I would call attention to the great value of auscultatory percussion. Why this method has not come into more general use, I am unable to say. It was applied to some extent by the late Dr. Alonzo Clarke, who demonstrated its use to his classes at the College of Physicians and Surgeons. But he used the solid stethoscope, the percussion being made by an assistant, and with this disadvantage it failed to excite the enthusiasm of his auditors. Since then I have very rarely seen it in use.

In practicing this method we now use the binåural stethoscope. If we wish to determine the outline of a solid organ, as, for example, the heart, we place the open end of the instrument over about the centre of the organ, and then with the index finger of the disengaged hand, tap lightly on the surface, beginning some distance from the stethoscope, and approaching nearer to it with each stroke. The moment we come to the border of the solid organ we shall perceive a change in the note, which will suddenly become louder and of a higher pitch. Not only can we map out the area of actual contact with the chest wall, but we shall be able to determine a zone around this area, in which the solid organ slopes away from the ribs. This may be done much more accurately than by ordinary percussion, and with taps so gentle as to be inaudible to the bystander. The results may be checked by reversing the mode of procedure, the stethoscope being placed at a distance from the organ to be mapped out, and the percussion practised over the latter, proceeding outward from the centre. As soon as the border is reached there will be a change of note.

This method of percussion is especially useful in enabling us to distinguish the dullness caused by one solid mass, from that caused by another continuous with it. Thus the line between hepatic and cardiac dullness is at once apparent, although not distinguishable by ordinary percussion. There is a change in the quality of the sound the instant we pass from one organ to the other. So, too, when we have a fluid above or below the liver, the boundaries of the latter may be accurately mapped out, when to ordinary percussion there would be only a continuous area of uniform flatness.

By placing the instrument in the median line over the upper third of the sternum, and tapping first under one clavicle and then under the other, we may appreciate slight degrees of relative dullness which might otherwise escape our notice.

Another great advantage of auscultatory percussion is that the blows are so gentle as not to cause pain under conditions of the great-

est sensitiveness. In acute pericarditis, or acute pleurisy, as well as in inflammatory conditions of solid organs, this is a matter of much consequence to the patient and, perchance, to the the physician.

A device for emphasizing small differences in the percussion note occured to me some years ago, and is capable, I think, of rendering essential service in certain cases. It consists in placing the thoracic extremity of the binaural stethoscope in the patient's mouth, the lips to be closed tightly about it, and the nostrils compressed by the patient's fingers. In this way an uninterrupted confined column of air is provided, reaching from the interior of the lung to the drum membrane o the observer's ear. When percussion is made upon any portion of the chest wall, the resulting vibrations of the subjacent air are conveyed along the confined column, with no opportunity for diffusion or escape. The result is a great intensification of the sound as compared with that propagated from the exterior of the chest through the unconfined atmosphere in which the greater part of the sound waves are lost by diffusion. In examining the posterior portion of the chest by this method, it is necessary that the percussion be intrusted to an assistant, although it would not be difficult to construct an instrument that would render such aid unnecessary.

This method of percussion is useful in distinguishing shades of difference between the apices in suspected phthisis. It also gives a peculiar intensity to the cracked-pot sound in cases of cavity.

In broncho-pneumonia it heightens the contrast between the consolidated and the unconsolidated, or the partly consolidated, areas. It delimits patches of thickened pleura very accurately. In short, while I do not claim that it is a very important accession to our means for physical exploration of the chest, it is still another resource when we find the others inadequate or inconclusive.

An application of oral auscultation, which antedates the method just described, was suggested some years ago by Dr. McCarroll, then interne in the Presbyterian Hospital. In a case of suspected thoracic aneurism, it occurred to him to place the extremity of the stethoscope in the patient's mouth, thinking the bruit, if one existed, might be conveyed along the air passages as the voice is through a speaking tube. This happy thought was rewarded in a most gratifying manner, as a bruit was distinctly heard which was not audible through the chest wall. Extending his observations he found that cardiac murmurs could be heard in this way, though, as a rule, not more distinctly than by external auscultation, and, of course, without any distinction of sound indicating the location at which the murmur was formed. There is, therefore, no special value in the method as applied to the study of heart lesions, but its occasional usefulness in discovering an aneurism of the thoriac aorta, which otherwise might escape detection, deserves

more notice than it has received. If the aneurism is so located as to be in direct relation with the trachea or one of the bronchi, a relatively distinct and well-defined bruit will be heard, but if the situation is lower down, the sound is diffused and relatively feeble.

It was these observations of Dr. McCarroll that suggested to me, some time later, the idea of oral auscultatory percussion.

While the physical signs of effusion into the pleural cavity are treated of in the text-books, as if they were so plain that "he who runs may read," they nevertheless often present in practice the most intricate puzzles in physical diagnosis we are called upon to solve. When we have an area in which there is absolute flatness, which changes its level with each change of the patient's position, and when within this area the respiratory and voice sounds are nearly or quite suppressed, and the vocal fremitus is absent, it scarcely requires the introduction of a needle to assure us of the presence of a fluid. But when the flatness shades off into dullness as we proceed upward, when change of position is without effect, when the breathing and voice sounds are heard to the very bottom of the chest, and perhaps with more or less of a bronchial character, when even crepitant and sub-crepitant rales are heard over parts of the area in question, and when in addition to all this the introduction of a needle gives negative results, we have in the physical signs a mass of contradictory evidence from which it is very difficult to reach a satisfactory verdict. We then need the aid of every device at our command which may throw light upon the diagnosis. The rational symptoms and the history of the case may be equally inconclusive. In the case I have in mind there had been a chill, followed by severe pain in the affected side, there was quickened respiration and a rapid bounding pulse, the temperature was elevated, the pulmonary second sound was accentuated, there was a suppressed cough, and only a little mucous expectoration. Proceeding with the investigation it was found that the affected side measured an inch more than the other, but its expansion was not more than one-third as great. Percussion, and especially auscultatory percussion, showed that the chest on that side was divided into three zones, the lowermost one presenting absolute flatness. Above this there was a zone in which light percussion gave a very dull, almost a flat sound, while heavier strokes showed a degree of resonance, increasing from below upward. Above this again was a fair degree of resonance, or a somewhat tympanitic sound. From this assemblage of signs and symptoms the conclusion was reached that there was a layer of fibrin at the bottom of the pleural cavity, and adhering to the chest wall as high up as the upper limit of the middle zone, the layer becoming thinner as it extended upward. Resting upon this layer, and separated by it from the chest wall, was a certain amount of fluid, not reaching so high, however, as the upper limit of the middle zone. This fluid transmitted

the respiration and the voice, to the bottom of the chest. The two pleural surfaces were adherent above, and the fluid was thus prevented from changing its position. The movements of the chest wall produced movement between the sticky and adhesive lymph and the surface of the costal pleura, and thus gave rise to the fine râles occasionally heard. By using a longer needle, and directing it somewhat more upward than in the first trial, the correctness of these deductions was verified.

But a still more difficult problem arises when we have both pneumonic consolidation and pleuritic effusion on the same side. In this case we derive some help from the more pronounced bronchial breathing and voice sounds. But when the consolidation occupies the base of the lung, in immediate relation with the fluid, these sounds are communicated, as it were, to the latter, and it is not easy to tell where the fluid ends, and the solidified lung begins. Here auscultatory percussion may be of the most decided service, enabling us to distinguish at once, when we pass from one source of flatness to the other, by a change in the character of the sound not appreciated by the usual methods of percussion.

Spirometry, once much in vogue, seems now to have fallen almost into disuse. Yet the indications afforded by it are valuable, and the more so as they are capable of exact record. Perhaps one reason that it has lost favor is that, as generally practiced, it is inherently uncleanly An instrument that is blown into by numbers of people of all sorts and conditions, and in all stages of pulmonary disease, and that cannot conveniently be cleansed after each use, must soon become repulsively and dangerously contaminated. This may be avoided by having the patient breathe from the receiver, instead of into it. The receiver, properly balanced, is filled with air by drawing it up to its fullest height, and the patient, having emptied his lungs as completely as possible, inhales from the instrument until his chest is expanded to the utmost. The number of cubic inches of air withdrawn from the receiver is then read off from the scale. If the instrument is properly arranged, the results should not vary from those procured in the usual manner. Of course the scale should read from below upward, instead of from above downward.

The chief usefulness of the spirometer, it appears to me, is in the indications it affords for pulmonary gymnastics. In no other way is the need for such exercises, in suitable cases, made so apparent, both to the practitioner and the patient, and in no other way can the good results be so readily demonstrated, and perseverance on the part of the patient secured. Moreover, the use of the instrument is in itself of no small value in correcting the very defects it brings to light. In fact, it is very common to find that a decided increase in the "vital capacity," to use Hutchinson's term, follows upon the first few efforts to inflate the lungs to their fullest limit.

The results of examinations by means of the spirometer (like those obtained by mensuration) being expressed by exact numbers, have a definiteness in marked contrast with the vague terms employed to express the results of auscultation and percussion. This makes them especially valuable for purposes of record.

Speaking of that last, which should naturally come first in order, it will add much to the completeness of an inspection of the thorax if we seat the patient in a chair and, standing behind him, look over his shoulders so as to observe the chest movements as seen from above. Differences in expansion in the two sides will be made apparent in this way, which would escape notice if we were looking in a direction perpendicular to the chest, for the same reason that we appreciate a movement across the line of vision more readily than one parallel to that line. Those who have not been in the habit of using this method of inspection, will be agreeably surprised at the practical results which it affords.

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